Project Summary

Title: Evaluation of Plant Density and Nitrogen Management on Yield and Quality of Promising Durum Wheat Lines in Temperate and Warm Climates

Project Code: 85131-0000-00-121800-100-3

Institution: Seed and Plant Improvement Institute, Agricultural Research, Education and Extension Organization (AREEO), Ministry of Agriculture Jihad, Iran

Principal Investigator: Mohammad Reza Mehrvar

Collaborators: Manoochehr Dastfal, Mohammad Sharif Al-Hosseini, Mohammad Lotfollahi, Farshid Navabi, Mohammad Ghasemzadeh Ganjei

Team Members: Hormoz Asadi, Kavous Rashmeh Karim, Alireza Mohammadi, Asadollah Rostami

Duration: 2005–2007 (2.5 years)

Locations: Karaj (temperate), Nishabur (temperate), Darab (warm climate)

Objective

This research aimed to determine optimal plant density and nitrogen management strategies to enhance the yield and quality of two promising durum wheat lines (D-81-6 and D-81-18) across different climatic zones in Iran.

Methodology

- **Design:** Strip-plot within randomized complete block design with three replications.
- **Plant Density Treatments:**
  - Temperate zones: 400, 500, 600 seeds/m²
  - Warm zone: 350, 450, 550 seeds/m²
- **Nitrogen Treatments:**
  - 10 fertilizer regimes using 138 and 184 kg/ha of pure nitrogen (urea source), split across various growth stages: sowing, tillering, stem elongation, and flowering.
  - Control treatments with no nitrogen application.
- **Data Analysis:** Simple and combined ANOVA, followed by Duncan's multiple range test for mean comparisons.

Key Findings

- **Karaj (Temperate):**
  - No significant yield increase with higher plant density; 400 seeds/m² recommended.
  - Nitrogen had a significant effect; 138 kg/ha with split application (sowing, late tillering, and either stem elongation or flowering) was optimal.
  - Highest nitrogen use efficiency (NUE): 20.1 kg grain/kg N; highest recovery: 49.2%.
- **Nishabur (Temperate):**
  - Plant density up to 500 seeds/m² recommended.
  - Nitrogen significantly affected yield; optimal rate up to 192 kg/ha with split applications.
  - Highest NUE: 21.7 kg grain/kg N; highest recovery: 54.9%.
- **Darab (Warm):**
  - Optimal density: 550 seeds/m².
  - Recommended nitrogen rate: 138 kg/ha with split application during late tillering and flowering.

Recommendations

- Avoid excessive nitrogen application beyond 138–192 kg/ha.
- Use split nitrogen applications tailored to local conditions and growth stages.
- In Karaj and Nishabur, two nitrogen management scenarios are recommended:
  1. Base application + topdressing at flowering.
  2. No base application + topdressing at tillering, stem elongation, and flowering.

Significance

This study provides region-specific guidelines for optimizing durum wheat production in Iran. It enhances nitrogen efficiency, reduces input costs, and improves grain quality, contributing to sustainable agricultural practices and food security.